

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

WHAT IS CLAIMED IS:

- 42  
X
1. A magnetic material manufacturing method for manufacturing a ribbon-shaped magnetic material by colliding a molten alloy to a circumferential surface of a cooling roll so as to cool and then solidify it, the ribbon-shaped magnetic material having an alloy composition represented by the formula of  $R_x(Fe_{1-y}Co_y)_{100-x-z}B_z$  (where R is at least one rare-earth element, x is 10 - 15at%, y is 0 - 0.30 and z is 4 - 10at%), wherein the circumferential surface of the cooling roll has dimple correcting means for dividing dimples to be produced on a roll contact surface of the ribbon-shaped magnetic material which is in contact with the circumferential surface of the cooling roll.
- B1
2. The manufacturing method as claimed in claim 1, wherein the cooling roll includes a roll base and an outer surface layer provided on an outer peripheral portion of the roll base, and the outer surface layer has said dimple correcting means.
3. The manufacturing method as claimed in claim 2, wherein the outer surface layer of the cooling roll is formed of a material having a heat conductivity lower than a heat conductivity of a structural material of the roll base at or around room temperature.
4. The manufacturing method as claimed in claim 2, wherein the outer surface layer of the cooling roll is formed of a ceramic.
5. The manufacturing method as claimed in claim 2, wherein the outer surface layer of the cooling roll is formed of a material having a heat conductivity equal to or less than  $80W\ m^{-1}\ K^{-1}$  at or around room temperature.
- 5b  
C1
6. The manufacturing method as claimed in claim 2, wherein the outer surface layer of the cooling roll is formed of a material having a coefficient of thermal expansion in a range of  $3.5 - 18 [x10^{-6}K^{-1}]$  at or around room temperature.

7. The manufacturing method as claimed in claim 2, wherein an average thickness of the outer surface layer of the cooling roll is 0.5 to 50 $\mu$ m.

8. The manufacturing method as claimed in claim 2, wherein the outer surface layer of the cooling roll is manufactured without experiencing a machining process.

9. The manufacturing method as claimed in claim 1, wherein the dimple correcting means includes at least one ridge provided on the circumferential surface of the cooling roll.

10. The manufacturing method as claimed in claim 9, wherein an average width of the ridge is 0.5 - 95 $\mu$ m.

11. The manufacturing method as claimed in claim 9, wherein the at least one ridge is provided by forming at least one groove in the circumferential surface of the cooling roll.

12. The manufacturing method as claimed in claim 11, wherein an average width of each groove is 0.5 - 90 $\mu$ m.

13. The manufacturing method as claimed in claim 11, wherein an average height of the ridge or an average depth of the groove is 0.5 - 20 $\mu$ m.

14. The manufacturing method as claimed in claim 11, wherein the ridge or groove is formed spirally with respect to a rotation axis of the cooling roll.

15. The manufacturing method as claimed in claim 11, wherein the at least one ridge or groove includes a plurality of ridges or grooves which are arranged in parallel with each other through an average pitch of 0.5 - 100 $\mu$ m.

16. The manufacturing method as claimed in claim 11, wherein a ratio of a projected area of the ridge or groove with respect to a

projected area of the circumferential surface is equal to or greater than 10%.

17. The manufacturing method as claimed in claim 1, wherein the method includes a step for milling the ribbon-shaped magnetic material.

✓18. A ribbon-shaped magnetic material which is manufactured by colliding a molten alloy to a circumferential surface of a cooling roll so as to cool and then solidify it, the ribbon-shaped magnetic material having an alloy composition represented by the formula of  $R_x(Fe_{1-y}Co_y)_{100-x-z}B_z$  (where R is at least one rare-earth element, x is 10 - 15at%, y is 0 - 0.30 and z is 4 - 10at%), wherein the circumferential surface of the cooling roll has dimple correcting means for dividing dimples to be produced on a roll contact surface of the ribbon-shaped magnetic material which is in contact with the circumferential surface of the cooling roll.

19. The ribbon-shaped magnetic material as claimed in claim 18, wherein grooves or ridges are formed in the roll contact surface so that produced dimples are divided by the grooves or ridges.

20. The ribbon-shaped magnetic material as claimed in claim 18, wherein the dimples produced on the roll contact surface of the ribbon-shaped magnetic material upon solidification thereof include huge dimples each having an area equal to or greater than  $2000\mu m^2$ , in which a ratio of an area in the roll contact surface occupied by thus produced huge dimples with respect to a total area of the roll contact surface of the ribbon-shaped magnetic material is equal to or less than 10%.

21. The ribbon-shaped magnetic material as claimed in claim 18, wherein the division of the dimples to be produced is carried out by transferring a shape of at least a part of the circumferential surface of the cooling roll to the roll contact surface of the ribbon-shaped magnetic material.

22. The ribbon-shaped magnetic material as claimed in claim 18, wherein an average thickness of the ribbon-shaped magnetic material is 8 - 50 $\mu$ m.

✓ 23. A powdered magnetic material which is obtained by milling a ribbon-shaped magnetic material which is manufactured by colliding a molten alloy to a circumferential surface of a cooling roll so as to cool and then solidify it, the ribbon-shaped magnetic material having an alloy composition represented by the formula of  $R_x(Fe_{1-y}Co_y)_{100-x-z}B_z$  (where R is at least one rare-earth element, x is 10 - 15at%, y is 0 - 0.30 and z is 4 - 10at%), wherein the circumferential surface of the cooling roll has dimple correcting means for dividing dimples to be produced on a roll contact surface of the ribbon-shaped magnetic material which is in contact with the circumferential surface of the cooling roll.

24. The powdered magnetic material as claimed in claim 23, wherein the magnetic powder is subjected to at least one heat treatment during or after a manufacturing process thereof.

25. The powdered magnetic material as claimed in claim 23, wherein an average particle size of the magnetic powder is 1 - 300 $\mu$ m.

26. The powdered magnetic material as claimed in claim 23, wherein the powdered magnetic material is mainly composed of a  $R_2TM_{14}B$  (here, TM is at least one transition metal) phase which is a hard magnetic phase.

27. The powdered magnetic material as claimed in claim 26, wherein a volume ratio of the  $R_2TM_{14}B$  phase with respect to the whole structure of the powdered magnetic material is equal to or greater than 80%.

28. The magnetic powder as claimed in claim 26, wherein an average crystal grain size of the  $R_2TM_{14}B$  phase is equal to or less than 500nm.

✓29. A bonded magnet manufactured by binding a powdered magnetic material which is obtained by milling a ribbon-shaped magnetic material which is manufactured by colliding a molten alloy to a circumferential surface of a cooling roll so as to cool and then solidify it, the ribbon-shaped magnetic material having an alloy composition represented by the formula of  $R_x(Fe_{1-y}Co_y)_{100-x-z}B_z$  (where R is at least one rare-earth element, x is 10 - 15at%, y is 0 - 0.30 and z is 4 - 10at%), wherein the circumferential surface of the cooling roll has dimple correcting means for dividing dimples to be produced on a roll contact surface of the ribbon-shaped magnetic material which is in contact with the circumferential surface of the cooling roll.

30. The bonded magnet as claimed in claim 29, wherein an intrinsic coercive force ( $H_{CJ}$ ) of the bonded magnet at room temperature lies within a range of 320 - 1200 kA/m.

31. The bonded magnet as claimed in claim 29, wherein a maximum magnetic energy product  $(BH)_{\max}$  of the bonded magnet is equal to or greater than  $40 \text{ kJ/m}^3$ .